



Digital Flow Switch  
**PFA/PFW Series**

For Air/For Water



Interchangeable flow rate  
Integrated display type and separate type  
2 independent flow rate settings are possible  
Water proof construction equivalent to IP65  
Bright and easy to read LED display/digital setting

# Series PFA

Digital Flow Switch

For Air



Bright and easy to read  
LED display/digital setting

For Air Digital Flow Switch

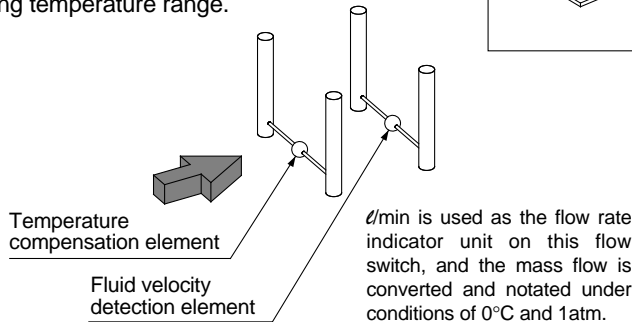
## Series PFA

2 independent flow  
rate settings are  
possible

Water proof

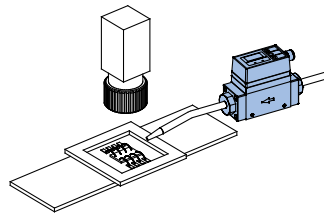
### Detection principle of digital flow switch for air

A heated thermistor is installed in the passage, and the fluid absorbs heat from the thermistor as it flows past it. The thermistor's resistance value drops as heat is absorbed, and since the drop ratio has a uniform relationship to the fluid velocity, it is possible to detect the fluid velocity by measuring this resistance value. To further compensate the fluid and ambient temperatures, there is also a built-in temperature sensor, making possible stable measurement within the operating temperature range.

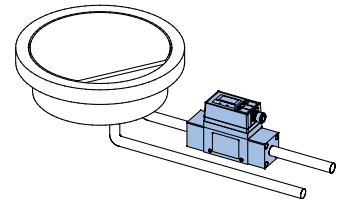


### Application examples

Flow control of N2 gas to detection camera shimmering for prevention of lead frame oxidation



Flow rate control of high frequency electric power supply cooling water for wafer temperature regulation



### For Air Series variations

Model	Measured flow range ℓ/min(SCFM)		Output specifications		Port size						
	1 to 10 (0.04 to 0.35)	5 to 50 (0.18 to 1.75)	NPN	PNP	Rc1/8	1/4	NPT1/8	1/4	G1/8	1/4	
Integrated display type	PFA710	●	●	●	●	●	●	●	●	●	
	PFA750		●	●	●	●	●	●	●	●	
Separate type	Display unit	PFA300	●								
		PFA301		●							
	Sensor unit	PFA510	●			●	●	●	●	●	●
		PFA550		●		●	●	●	●	●	●

2 types for different applications

Integrated display type  
and separate type



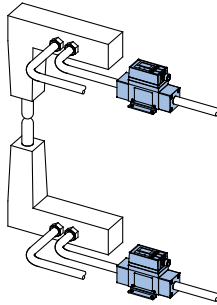
Can be switched from  
real-time flow rate to  
accumulated flow rate

For Water Digital Flow Switch  
**Series PFW**

construction equivalent to IP65

### Detection principle of digital flow switch for water

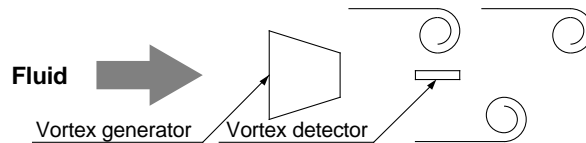
Flow control of cooling water for welding gun



When a bar shaped object (vortex generator) is placed in the flow, reciprocal vortices are generated on the downstream side. These vortices are stable under certain conditions, and their frequency is proportional to the flow velocity, resulting in the following formula.

$$f = k \times v$$

f: Frequency of vortices, v: Flow velocity, k: Proportional constant (determined by the vortex generator's dimensions, shape, etc.) Therefore, the flow rate can be measured by detecting this frequency.

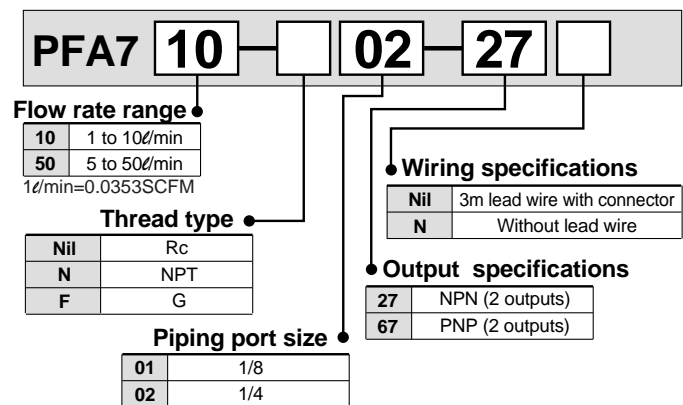


### For Water Series variations

	Model	Measured flow range ℓ/min (SCFM)			Output specifications		Port size								
		0.5 to 4 (0.02 to 0.4)	2 to 16 (0.07 to 0.56)	5 to 40 (6.18 to 1.41)	NPN	PNP	Rc 3/8	1/2	3/4	NPT 3/8	1/2	3/4	G 3/8	1/2	3/4
Integrated display type	New PFW704	●			●	●	●			●			●		
	PFW720		●		●	●	●	●	●	●	●	●	●	●	●
	New PFW740			●	●	●		●	●	●	●	●	●	●	●
Separate type	Display unit	PFW300		●		●									
		New PFW310	●			●									
		New PFW320			●	●									
		New PFW301		●			●								
		New PFW311	●				●								
	Sensor unit	New PFW321			●		●								
		New PFW504	●					●		●			●		
		New PFW520		●				●	●	●	●	●	●	●	●
		New PFW540			●				●	●	●	●	●	●	●



## How to order



## Specifications

Model	PFA710-□-□	PFA750-□-□
Measured fluids	Dry air, N <sub>2</sub>	
Detection type	Heater type	
Flow rate measurement and setting range	1 to 10ℓ/min (0.04 to 0.35SCFM)	5 to 50ℓ/min (0.18 to 1.77SCFM)
Minimum setting unit	0.1ℓ/min (0.004SCFM)	0.5ℓ/min (0.02SCFM)
Display units	ℓ/min, CFM x 10 <sup>-2</sup>	
	ℓ, ft <sup>3</sup> x 10 <sup>-1</sup>	
Operating pressure range	0 to 0.5MPa (0 to 72psi)	
Withstanding pressure	1.0MPa (145psi)	
Pressure loss	3kPa (50ℓ/min) [0.44psi (1.77SCFM)]	
Cumulative flow rate range	0 to 999999ℓ (0 to 35,300 ft <sup>3</sup> )	
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation	
Linearity	± 5% F.S. or less	
Repeatability	± 1% F.S. or less	
Temperature characteristics	± 3% F.S. or less (15 to 35°C [59 to 95°F]) ± 5% F.S. or less (0 to 50°C [32 to 122°F])	
Output specifications <sup>Note1)</sup>	27: NPN open collector, 30V, 80mA, 2 outputs 67: PNP open collector, 80mA, 2 outputs	
Operation indicator lights	Lights up when ON OUT1: Green OUT2: Red	
Response time	1s	
Hysteresis	Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed 3digits <sup>Note2)</sup>	
Power supply voltage	12 to 24VDC (ripple ± 10% or less)	
Current consumption	150mA or less	
Withstand voltage	1000VAC for 1min. between external terminal block and case	
Insulation resistance	2MΩ (500VDC) between external terminal block and case	
Noise resistance	1000Vp-p, Pulse width 1μs, Rise time 1ns	
Vibration resistance	10 to 500Hz at the smaller of amplitude 1.5mm or acceleration 98m/s <sup>2</sup> in X, Y, Z directions for 2 hours each	
Impact resistance	490m/s <sup>2</sup> in X, Y, Z directions, 3 times each	
Weight	250g (8.8oz) (not including lead wires)	
Enclosure	Equivalent to IP65	
Piping port size	1/8, 1/4	

Note 1) The output functions (2 outputs OUT1 and OUT2) operate only with respect to the real-time flow rate display, and do not operate with respect to the accumulated flow rate display.  
 Note 2) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).



## How to Order

## Display Unit

**PFA 30 0 A**

**Mounting**

A	Panel mount
B	DIN rail, wall mount

**Adapter part no. for panel mount**

Description	Panel adapter B
Part No.	ZS-22-02

**Output specifications**

0	NPN (2 outputs)
1	PNP (2 outputs)

## Specifications

Model	PFA300-□	PFA301-□
Flow rate range measurement & setting <sup>Note 1)</sup>	1 to 10, 5 to 50ℓ/min (0.04 to 0.35, 0.18 to 1.77SCFM)	
Minimum setting unit	1% of maximum flow rate range	
Display units	Real-time flow rate	ℓ/min, CFM x 10 <sup>-2</sup>
	Accumulated flow rate	ℓ, ft <sup>3</sup> x 10 <sup>-1</sup>
Cumulative flow rate range	0 to 999999ℓ (0 to 35,300ft <sup>3</sup> )	
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation	
Linearity <sup>Note 2)</sup>	± 5% F.S. or less	
Repeatability <sup>Note 2)</sup>	± 1% F.S. or less	
Temperature characteristics <sup>Note 2)</sup>	± 3% F.S. or less (15 to 35°C [59 to 95°F]) ± 5% F.S. or less (0 to 50°C [32 to 122°F])	
Output specifications <sup>Note 3)</sup>	NPN open collector, 30V 80mA, 2 outputs	PNP open collector 80mA, 2 outputs
Operation indicator lights	Lights up when ON OUT1: Green OUT2: Red	
Response time	1s	
Hysteresis	Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed, 3 digits <sup>Note 4)</sup>	
Power supply voltage	12 to 24VDC (ripple ± 10% or less)	
Current consumption	50mA or less	
Enclosure	Equivalent to IP40	
Weight	45g (1.6oz)	

Note 1) The flow rate measurement range can change depending on the setting.

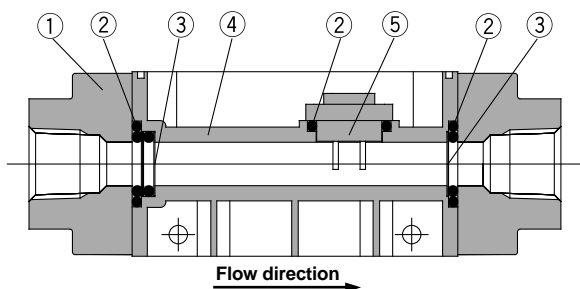
Note 2) The system accuracy when combined with PFA510 and PFA550.

Note 3) The output functions (2 outputs, OUT1 and OUT2) operate only with respect to the real-time flow rate display, and do not operate with respect to the accumulated flow rate display.

Note 4) Window comparator mode —  
Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more.  
1 digit is the minimum setting unit (refer to the table above).

## Construction

For air



## How to Order

## Sensor Unit

**PFA5 10 02**

**Flow rate range**

10	1 to 10ℓ/min
50	5 to 50ℓ/min

1ℓ/min=0.0353SCFM

**Wiring specifications**

Nil	3m lead wires with connector
N	Without lead wires

**Thread type**

Nil	Rc
N	NPT
F	G

**Piping port size**

01	1/8
02	1/4

## Specifications

Model	PFA510-□	PFA550-□
Measured fluids	Dry air, N <sub>2</sub>	
Detection type	Heater type	
Flow rate measurement and setting range	1 to 10ℓ/min (0.04 to 0.35SCFM)	5 to 50ℓ/min (0.18 to 1.77SCFM)
Operating pressure range	0 to 0.5MPa (0 to 72psi)	
Withstanding pressure	1.0MPa (145psi)	
Pressure loss	3kPa (50ℓ/min) [0.4psi (1.77SCFM)]	
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation	
Power supply voltage	12 to 24VDC (ripple ± 10% or less)	
Current consumption	100mA or less	
Weight	200g (7oz)(not including lead wires)	
Enclosure	Equivalent to IP65	
Piping port size	1/8, 1/4	

## Parts list

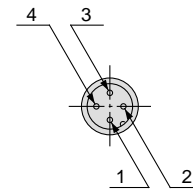
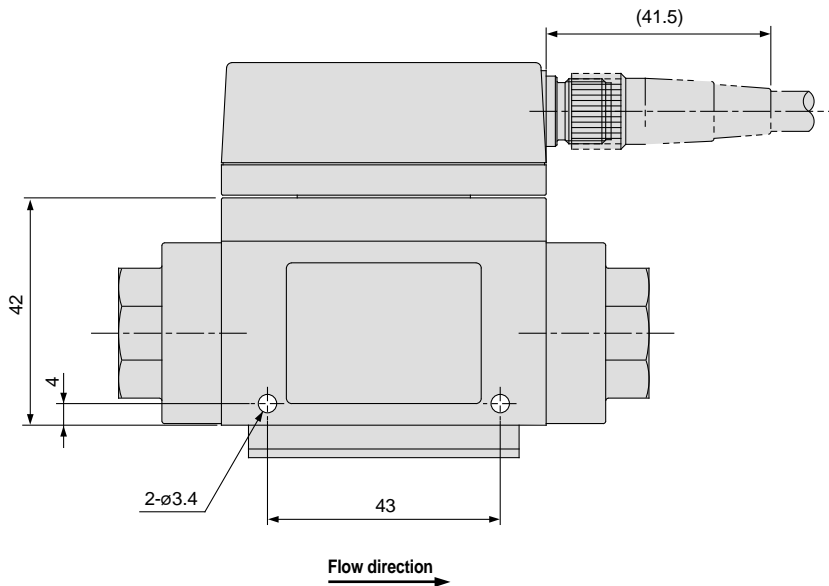
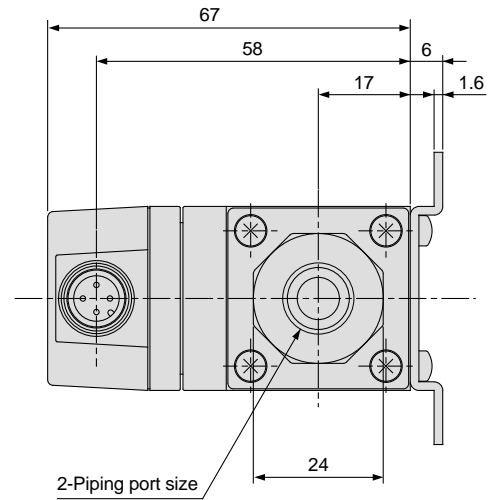
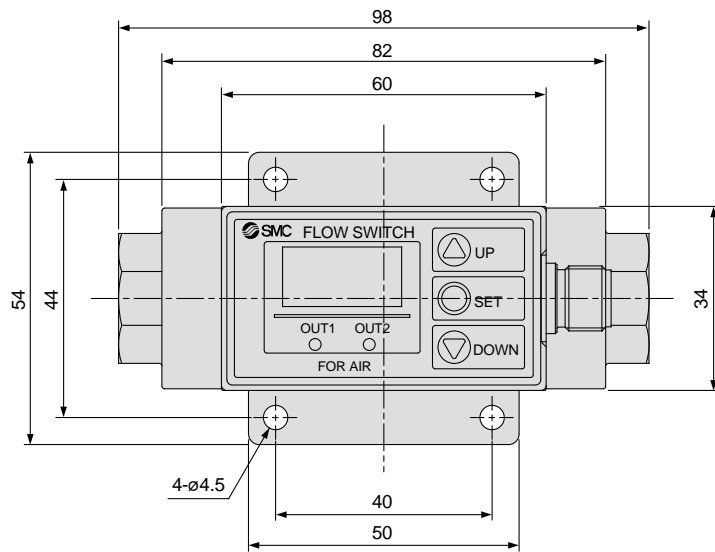
No.	Description	Material
1	Attachment	ADC
2	Seal	NBR
3	Mesh	SUS
4	Body	PBT
5	Sensor	PBT

## Dimensions (mm) / **For Air** Integrated Display Type

1in=25.4mm

PFA7  $\frac{1}{5}$  0-□ -27 (N) / -67 (N)

**Scale: 70%**



**Connector pin numbers**

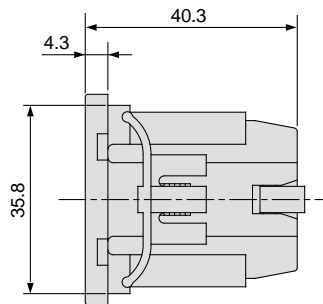
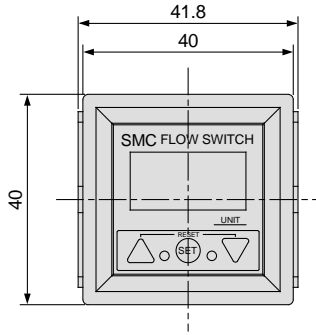
Pin No.	Pin name
1	DC (+)
2	OUT 2
3	DC (-)
4	OUT 1

## Dimensions (mm)/ For Air Separate Type

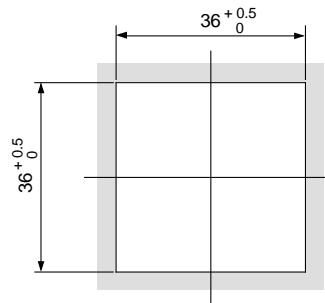
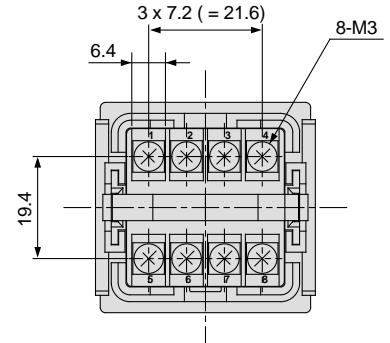
1in=25.4mm

Scale: 70%

### PFA30□-A Display unit Panel mount

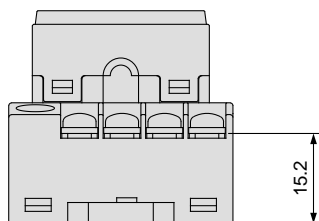
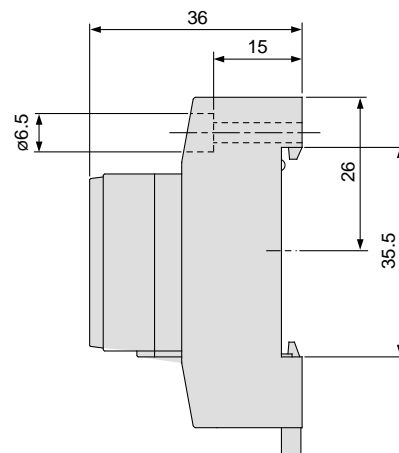
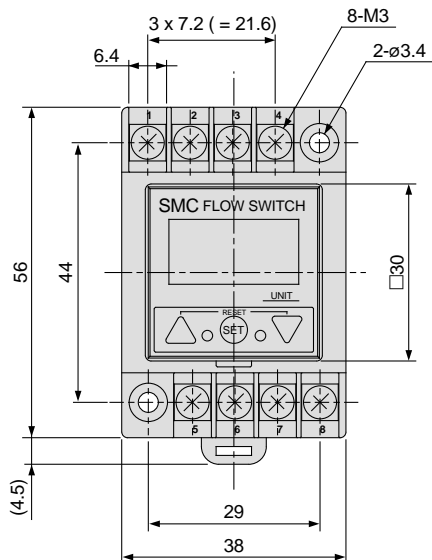


Panel cutout dimensions



\* The applicable panel thickness is 1 to 3.2mm

### PFA30□-B Display unit DIN rail



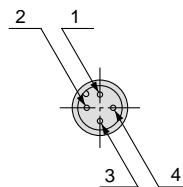
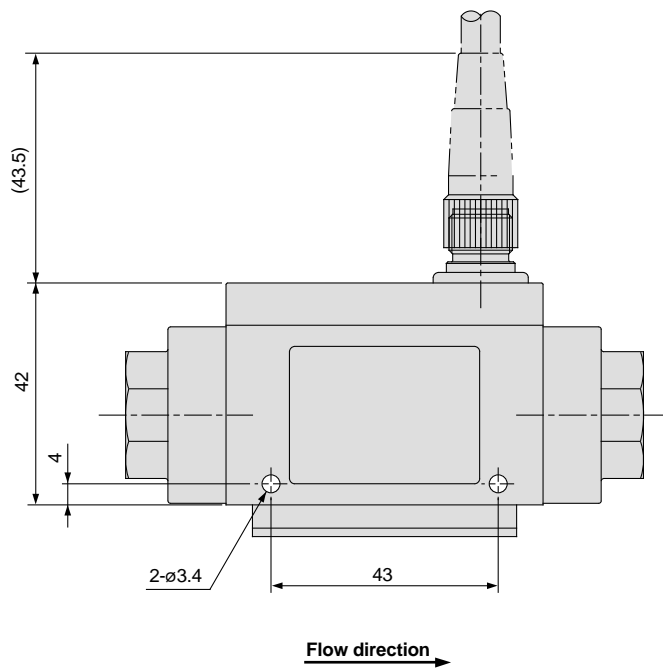
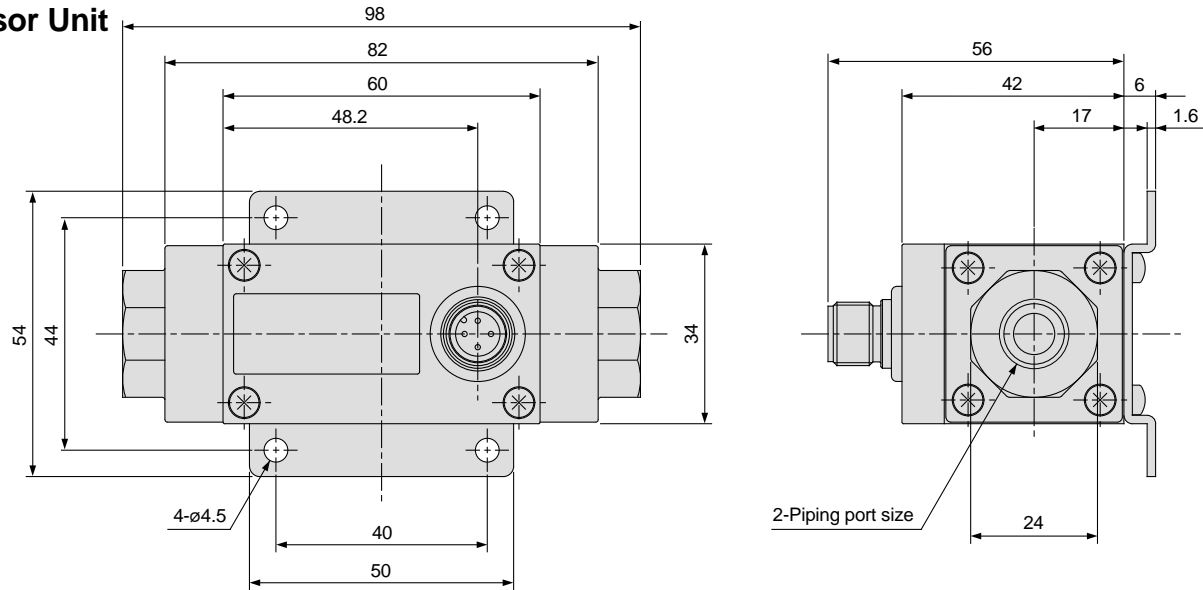
## Dimensions (mm) **For Air** Separate Type

1in=25.4mm

**Scale: 70 %**

### PFA5 $\frac{1}{5}$ 0-□ (N)

#### Sensor Unit



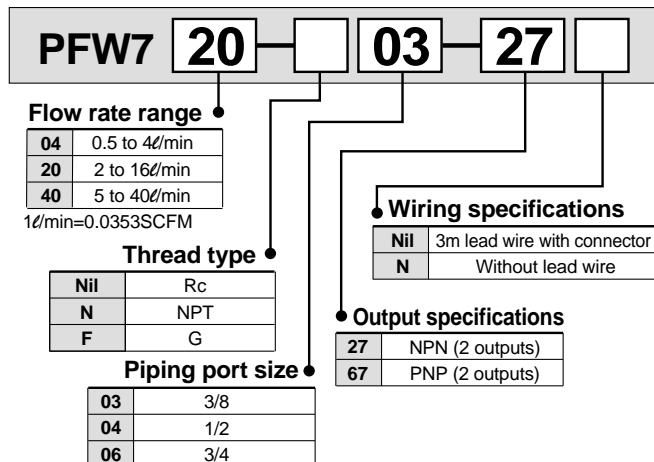
#### Connector pin numbers

Pin No.	Pin name
1	DC (+)
2	NC
3	DC (-)
4	OUT





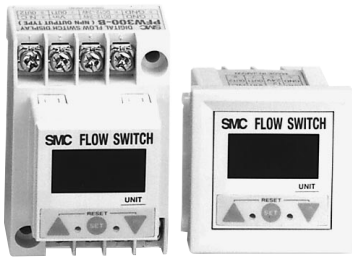
How to order



Specifications

Model	PFW704-□-□	PFW720-□-□	PFW740-□-□
Measured fluids	Water		
Detection type	Karman vortex type		
Flow rate measurement and setting range	0.5 to 4ℓ/min (0.02 to 0.14SCFM) [setting is 0.6 to 4ℓ/min (0.02 to 0.14SCFM)]	2 to 16ℓ/min (0.07 to 0.56SCFM)	5 to 40ℓ/min (0.18 to 1.41SCFM)
Minimum setting unit	0.05ℓ/min (0.002SCFM)	0.1ℓ/min (0.004SCFM)	0.5ℓ/min (0.02CFM)
Display units	Instantaneous flow rate	ℓ/min, gal (US) /min	
	Cumulative flow rate	ℓ, gal (US)	
Operating pressure range	0 to 1MPa (0 to 145psi)		
Withstanding pressure	1.5MPa (218psi)		
Cumulative flow rate range	0 to 999999ℓ (0 to 35,300ft <sup>3</sup> )		
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation		
Linearity	± 5% F.S. or less		
Repeatability	± 3% F.S. or less		
Temperature characteristics	± 5% F.S. or less (0 to 50°C [32 to 122°F])		
Output specifications <sup>Note1)</sup>	27: NPN open collector, 30V, 80mA, 2 outputs 67: PNP open collector, 80mA, 2 outputs		
Operation indicator lights	Lights up when ON OUT1: Green OUT2: Red		
Response time	1s		
Hysteresis	Hysteresis mode: Variable (can be set from 0), Window comparater mode: Fixed 3 digits <sup>Note2)</sup>		
Power supply voltage	12 to 24VDC (ripple ± 10% or less)		
Current consumption	70mA or less		
Withstand voltage	1000VAC for 1min. between external terminal block and case		
Insulation resistance	2MΩ (500VDC) between external terminal block and case		
Noise resistance	1000Vp-p, Pulse width 1μs, Rise time 1ns		
Vibration resistance	10 to 500Hz at the smaller of amplitude 1.5mm or acceleration 98m/s <sup>2</sup> in X, Y, Z directions for 2 hours each		
Impact resistance	490m/s <sup>2</sup> in X, Y, Z directions, 3 times each		
Weight	460g (16.2oz) not including lead wires	520g (18.4oz) not including lead wires	700g (24.7oz) not including lead wires
Enclosure	Equivalent to IP65		
Piping port size	3/8	3/8, 1/2	1/2, 3/4

Note 1) The output functions (2 outputs OUT1 and OUT2) operate only with respect to the real-time flow rate display, and do not operate with respect to the accumulated flow rate display.  
 Note 2) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).



## How to Order

## Display Unit

**PFW 3 0 0 - A**

### Flow rate range

1	0.5 to 4ℓ/min
0	2 to 16ℓ/min
2	5 to 40ℓ/min

1ℓ/min=0.0353SCFM

### Output specifications

0	NPN (2 outputs)
1	PNP (2 outputs)

### Mounting

A	Panel mount
B	DIN rail, wall mount

### Adapter part no. for panel mount

Description	Panel adapter B
Part No.	ZS-22-02

## Specifications

Model	PFW310-□	PFW311-□	PFW300-□	PFW301-□	PFW320-□	PFW321-□
Flow rate range measurement and setting	0.5 to 4ℓ/min (0.02 to 0.14SCFM) [Setting is 0.6 to 4ℓ/min (0.02 to 0.14SCFM)]		2 to 16ℓ/min (0.07 to 0.56SCFM)		5 to 40ℓ/min (0.18 to 1.41SCFM)	
Minimum setting unit	0.05ℓ/min (0.002SCFM)		0.1ℓ/min (0.004SCFM)		0.5ℓ/min (0.02SCFM)	
Display units	Real-time flow rate					
	Accumulated flow rate					
Cumulative flow rate range	ℓ/min, gal (US) /min ℓ, gal (US) 0 to 999999ℓ (35,300ft <sup>3</sup> )					
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation					
Linearity <sup>Note 1)</sup>	± 5% F.S. or less					
Repeatability <sup>Note 1)</sup>	± 3% F.S. or less					
Temperature characteristics <sup>Note 1)</sup>	± 5% F.S. or less (0 to 50°C [32 to 122°F])					
Output specifications <sup>Note 2)</sup>	NPN open collector 30V, 80mA, 2 outputs	PNP open collector 80mA, 2 outputs	NPN open collector 30V, 80mA, 2 outputs	PNP open collector 80mA, 2 outputs	NPN open collector 30V, 80mA, 2 outputs	PNP open collector 80mA, 2 outputs
Operation indicator lights	Lights up when ON OUT1: Green OUT2: Red					
Response time	1s					
Hysteresis	Hysteresis mode: Variable (can be set from 0) Window comparator mode: Fixed 3 digits <sup>Note3)</sup>					
Power supply voltage	12 to 24VDC (ripple ± 10% or less)					
Current consumption	50mA or less					
Weight	45g (1.6oz)					
Enclosure	Equivalent to IP40					

Note 1) The system accuracy when combined with PFW5□□□.

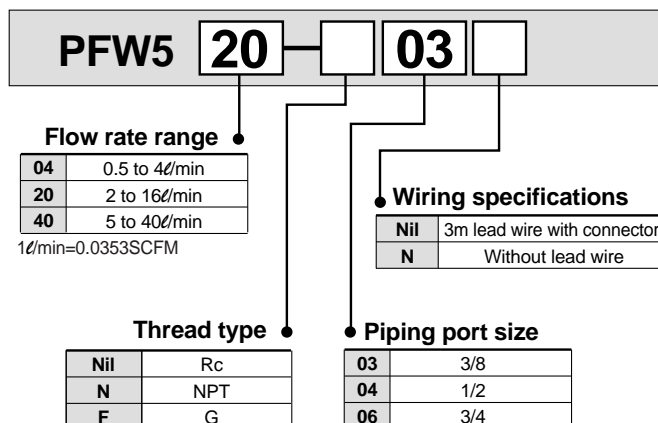
Note 2) The output functions ( 2 outputs OUT1 and OUT2) operate only with respect to the real-time flow rate display, and do not operate with respect to the accumulated flow rate display.

Note 3) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).



## How to order

Sensor Unit

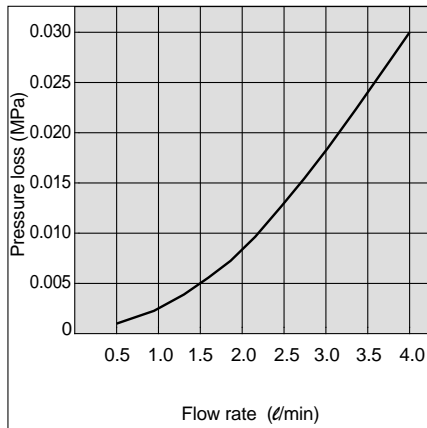


## Specifications

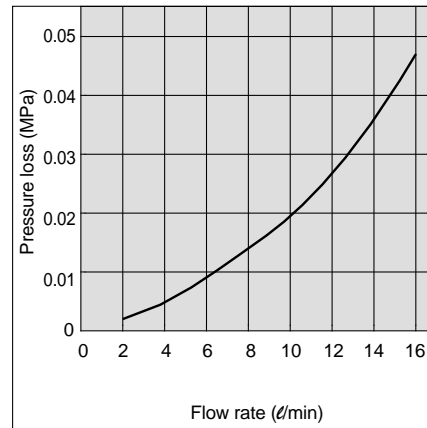
Model	PFW504-□	PFW520-□	PFW540-□
Measured fluids	Water		
Detection type	Karman vortex type		
Flow rate measurement range	0.5 to 4ℓ/min (0.02 to 0.14SCFM)	2 to 16ℓ/min (0.07 to 0.56SCFM)	5 to 40ℓ/min (0.18 to 1.41SCFM)
Operating pressure range	0 to 1MPa (0 to 145psi)		
Withstanding pressure	1.5MPa (218psi)		
Operating temperature range	0 to 50°C (32 to 122°F) with no condensation		
Power supply voltage	12 to 24VDC (ripple ± 10% or less)		
Current consumption	20mA or less		
Weight	410g (14.5oz) (not including lead wires)	470g (16.6oz) (not including lead wires)	650g (22.9oz) (not including lead wires)
Enclosure	Equivalent to IP65		
Piping port size	3/8	3/8, 1/2	1/2, 3/4

## Flow Rate Characteristics (Pressure Loss)

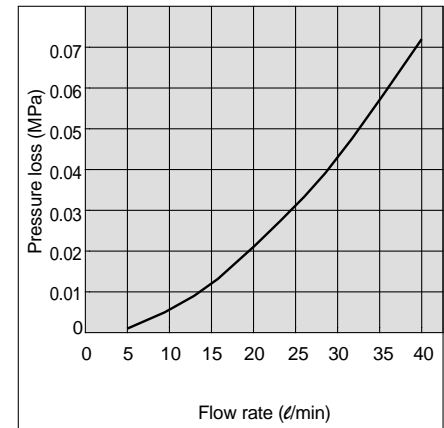
**PFW704, 504**



**PFW720, 520**

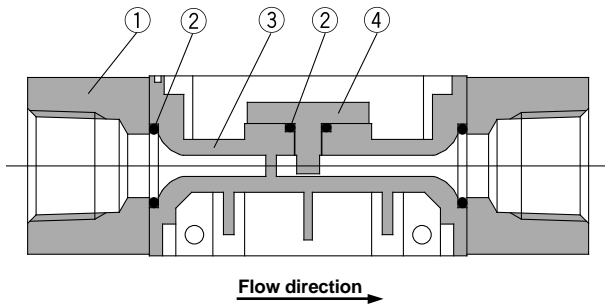


**PFW740, 540**



1MPa=145psi  
1l/min=0.0353SCFM

## Construction



### Parts list

No.	Description	Material
1	<b>Attachment</b>	SUS
2	<b>Seal</b>	NBR
3	<b>Body</b>	PPS
4	<b>Sensor</b>	PPS

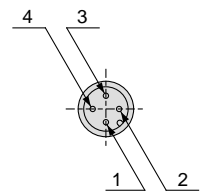
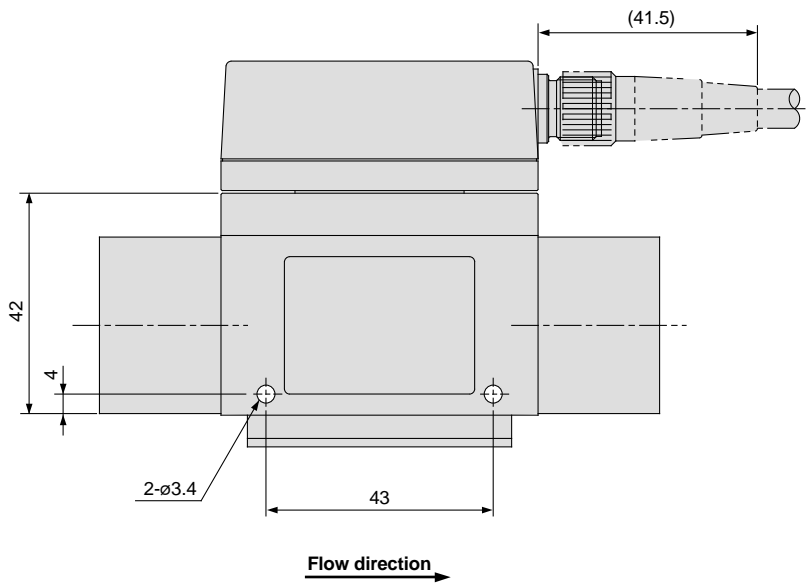
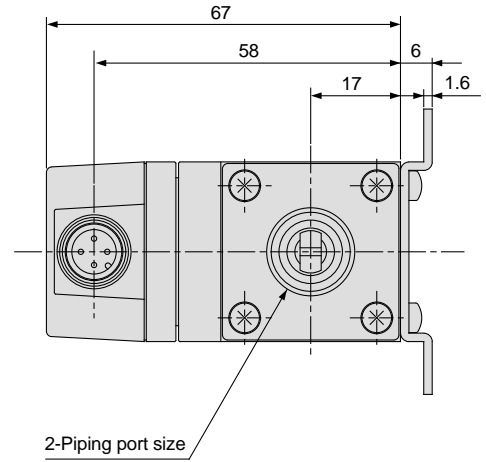
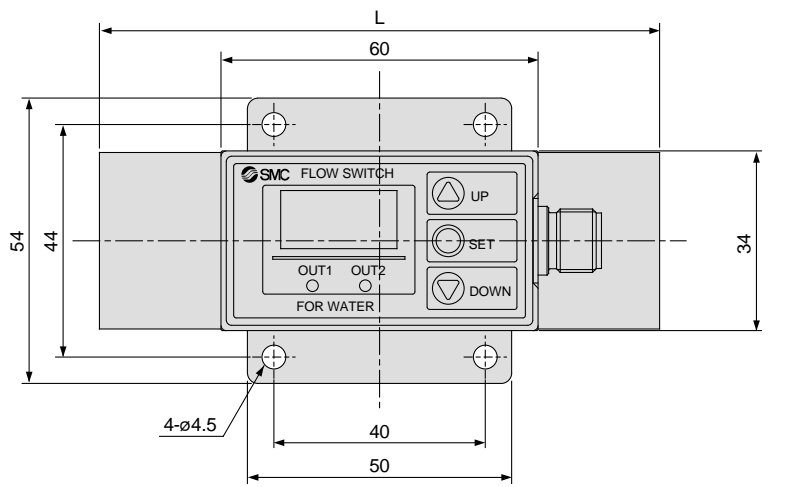
## Dimensions (mm)/ For Water Integrated Display Type

1in = 25.4mm

Scale: 70%

PFW704-□ -27 (N)  
-67 (N)

PFW720-□ -27 (N)  
-67 (N)



Connector pin numbers

Pin No.	Pin name
1	DC (+)
2	OUT 2
3	DC (-)
4	OUT 1

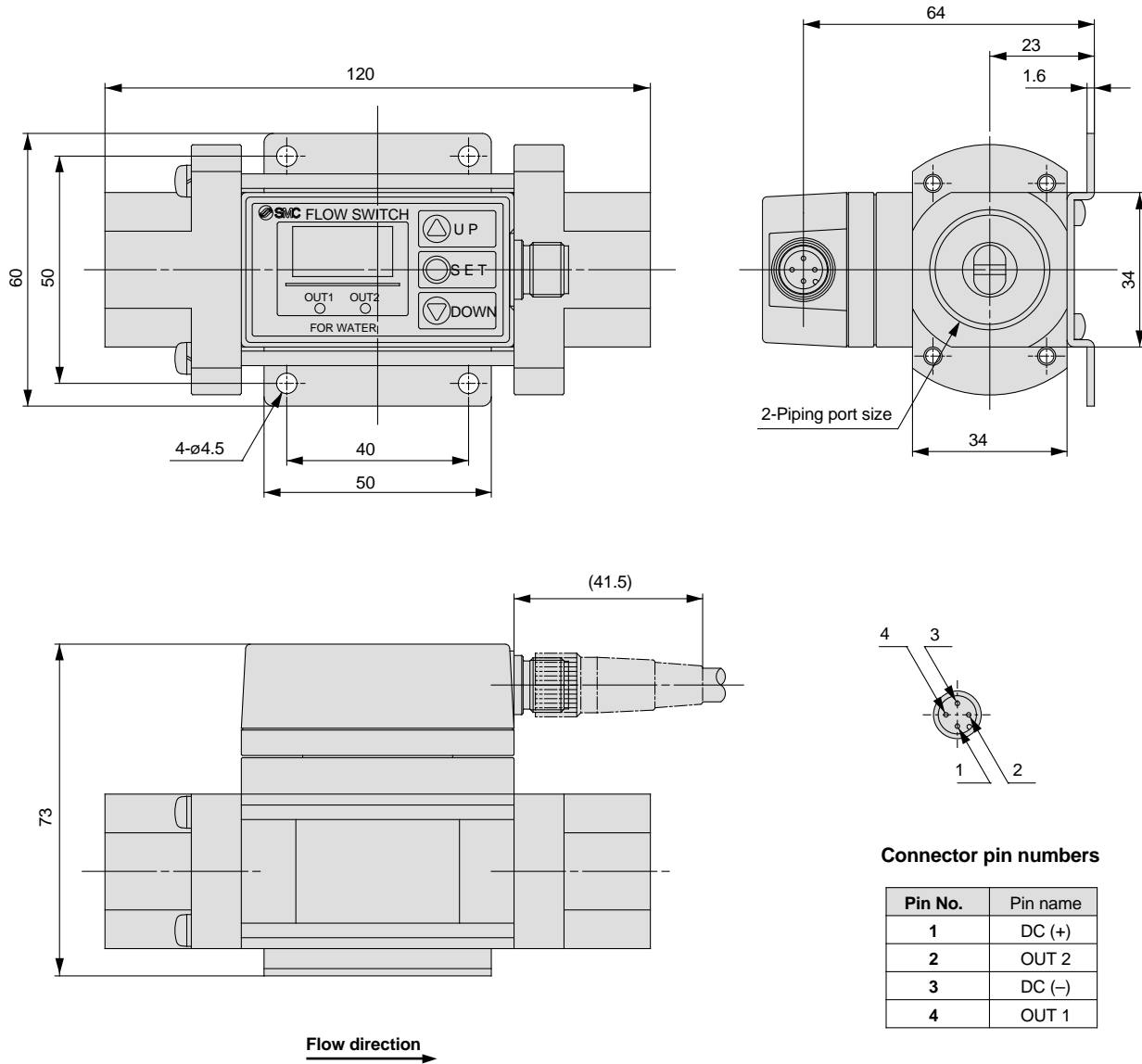
Model	Dimension L
PFW704	100
PFW720	106

## Dimensions (mm) **For Water** Integrated Display Type

1 in = 25.4mm

PFW740-□-27 (N)  
-67 (N)

**Scale: 65%**



**Connector pin numbers**

Pin No.	Pin name
1	DC (+)
2	OUT 2
3	DC (-)
4	OUT 1

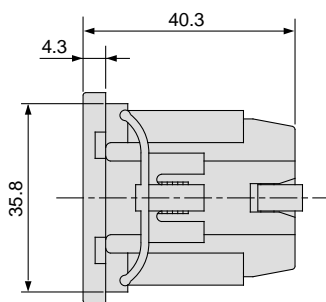
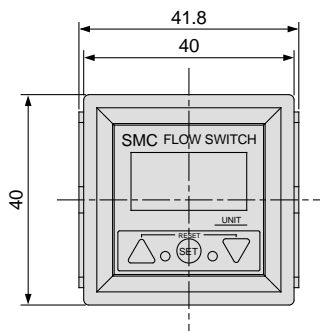
## Dimensions (mm) / **For water** Separate Type

1in = 25.4mm

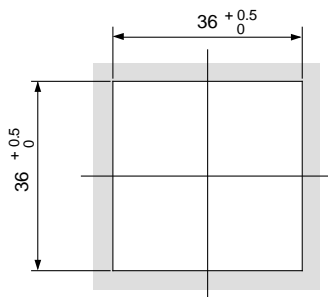
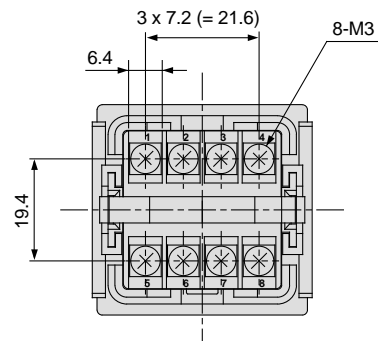
**Scale:70%**

### PFW3□□-A

Display unit Panel mount



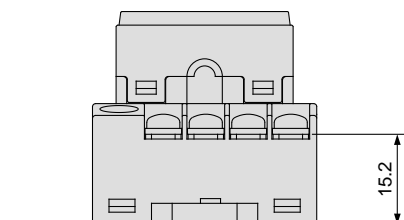
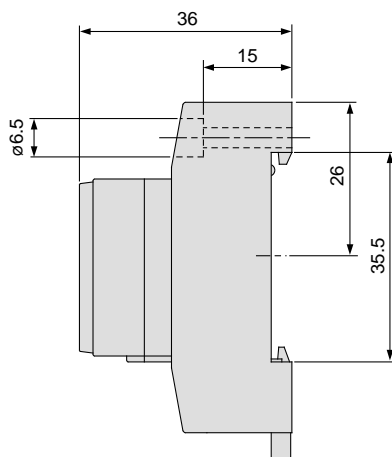
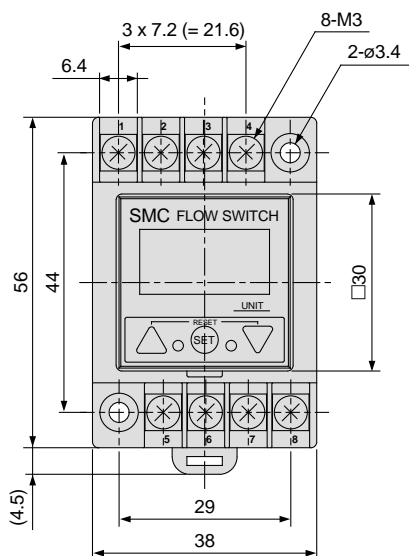
Panel cutout dimensions



\* The applicable panel thickness is 1 to 3.2mm

### PFW3□□-B

Display unit DIN rail



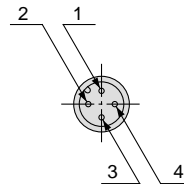
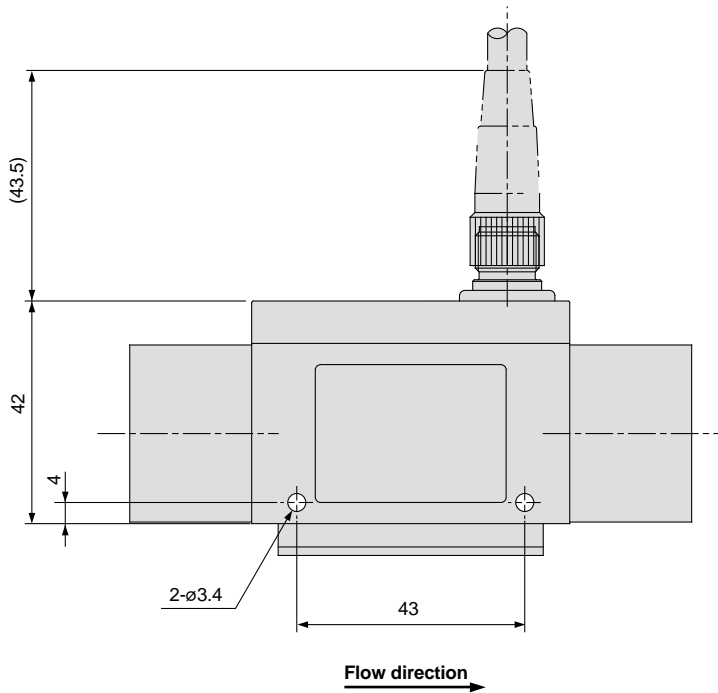
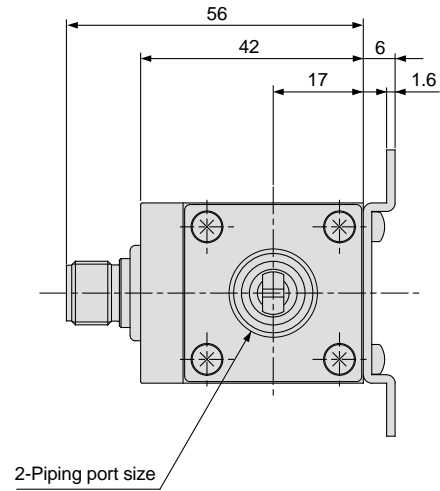
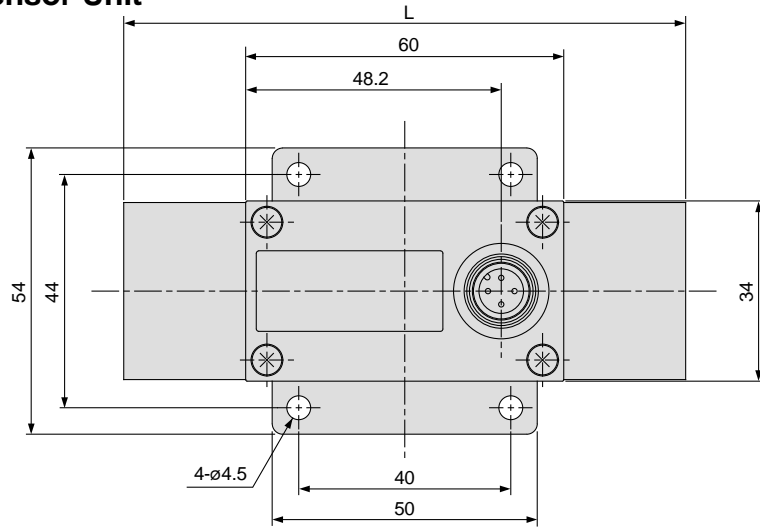
## Dimensions (mm)/ For Water Separate Type

1in = 25.4mm

Scale: 70%

PFW504-□ (N)  
PFW520-□ (N)

Sensor Unit



Connector pin numbers

Pin No.	Pin name
1	DC (+)
2	NC
3	DC (-)
4	OUT

Model	Dimension L
PFW504	100
PFW520	106

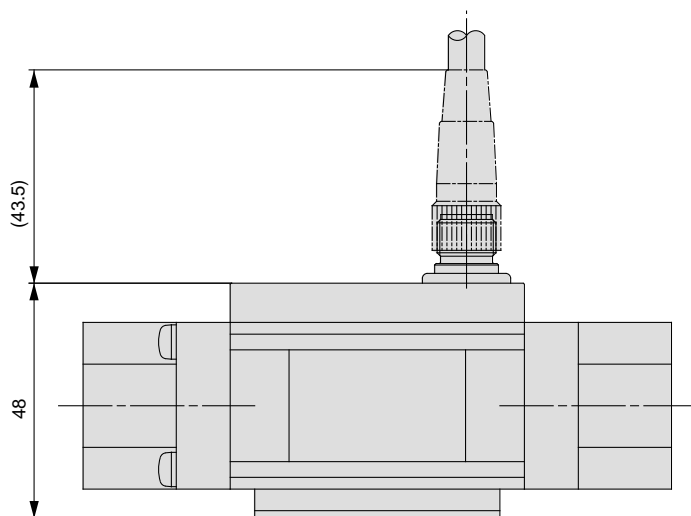
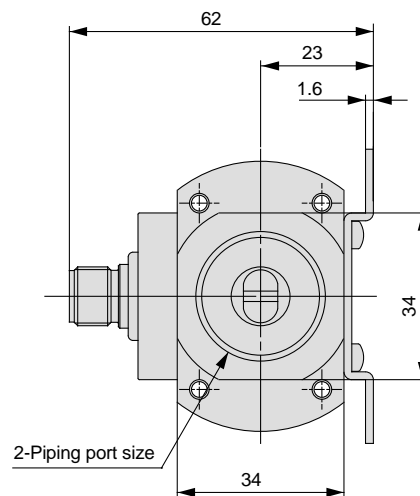
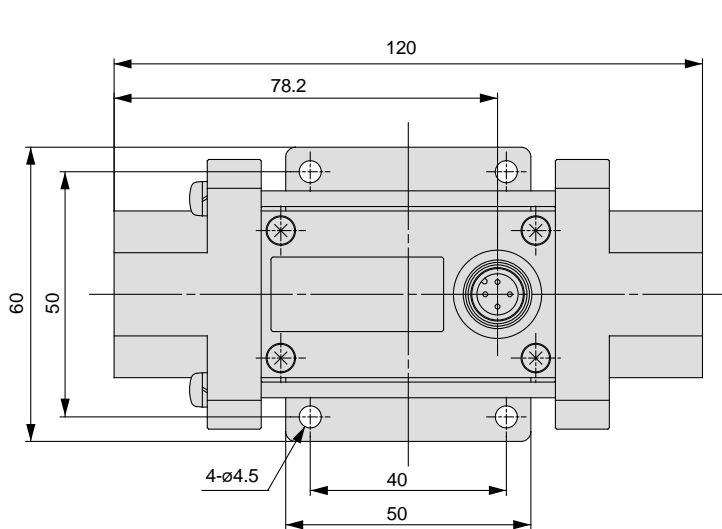


Dimensions (mm) **For Water** Separate Type

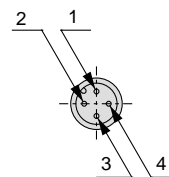
1 in = 25.4mm

**Scale: 65%**

**PFW540-□ (N)**



**Flow direction** →



**Connector pin numbers**

Pin No.	Pin names
1	DC (+)
2	NC
3	DC (-)
4	OUT

## Operating Unit Nomenclature

### RESET Buttons

Pressing the UP and DOWN buttons simultaneously activates the RESET function.

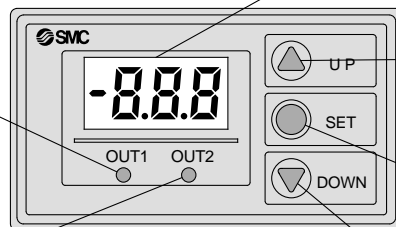
This clears the unit when an abnormality occurs and clears the cumulative flow rate display to "0".

### Output (OUT1) Indicator/Green

Lights up when OUT1 is ON.  
It also blinks when an overcurrent error occurs on OUT1.

### Output (OUT2) Indicator/Red

Lights up when OUT2 is ON.  
It also blinks when an overcurrent error occurs on OUT2.



### LED Display

Displays the instantaneous flow rate, cumulative flow rate, and setting value. The **■** mark blinks when the cumulative flow rate is being measured.

### UP Button (▲Button)

Use when increasing a setting value.

### SET Button (● Button)

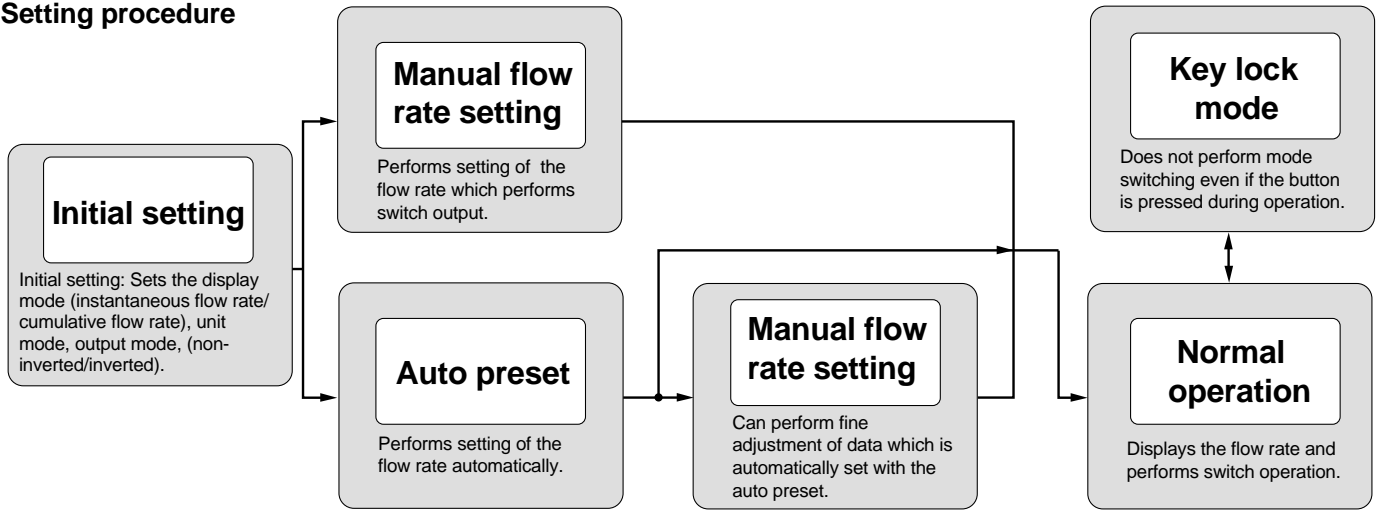
Use when changing a setting value or any of the modes.

### DOWN Button (▼ Button)

Use when decreasing a setting value.

## Flow Rate Setting

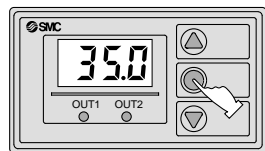
### Setting procedure



### Initial setting

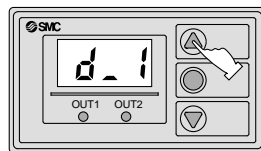
Note) Operation is the same for the integrated display type and the separate type (display unit).

#### 1. Initial Setting Mode



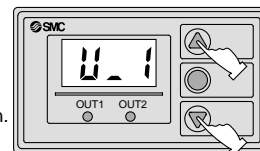
Press the SET button for 1 second or more. Since the display will change from  $F_{.1}$  to  $d_{.1}$  or  $d_{.2}$ , release the SET button after it has changed.

#### 2. Selection of the Display Mode



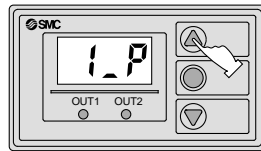
Performs setting of the display mode. Switches with the G button.  
 $d_{.1}$  : Instantaneous flow rate display  
 $d_{.2}$  : Cumulative flow rate display

#### 3. Selection of Display Units



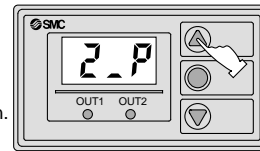
Performs setting of units. Switches with the G button and H button.  
 $U_{.1}$  Unit number  
 (Refer to Table 1.)

#### 4. Selection of OUT1 Output Mode



Performs setting of the OUT1 output mode. Switches the OUT1 output mode with the G button.  
 $1_P$  : Non-inverted output  
 $1_n$  : Inverted output  
 (Refer to Table 2.)

#### 5. Selection of OUT2 Output Mode



Performs setting of the OUT2 output mode. Switches the OUT2 output mode with the G button.  
 $2_P$  : Non-inverted output  
 $2_n$  : Inverted output

**Table 1**

#### For air

Display	Instantaneous flow rate	Cumulative flow rate
$U_{.1}$	l/min	l
$U_{.2}$	CFM x 10 <sup>-2</sup>	ft <sup>3</sup> x 10 <sup>-1</sup>

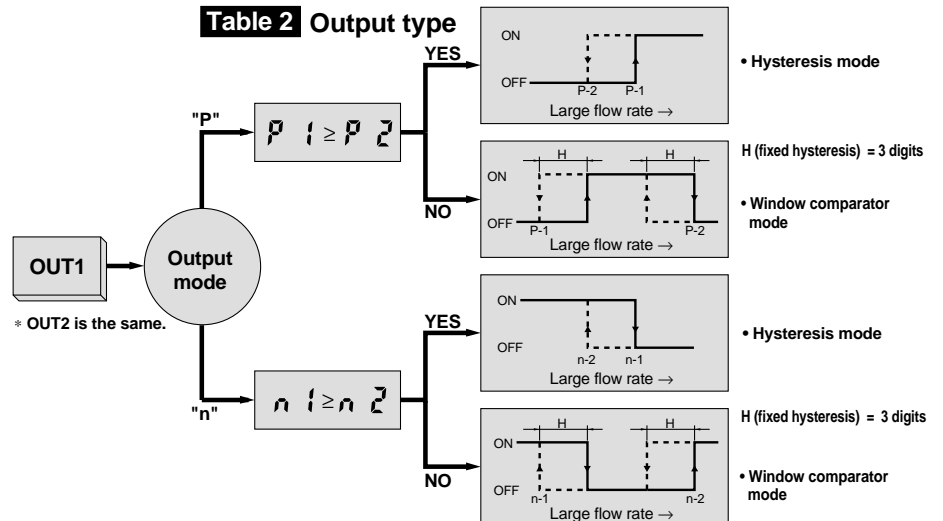
CFM = ft<sup>3</sup>/min

#### For water

Display	Instantaneous flow rate	Cumulative flow rate
$U_{.1}$	l/min	l
$U_{.2}$	GPM	gal (US)

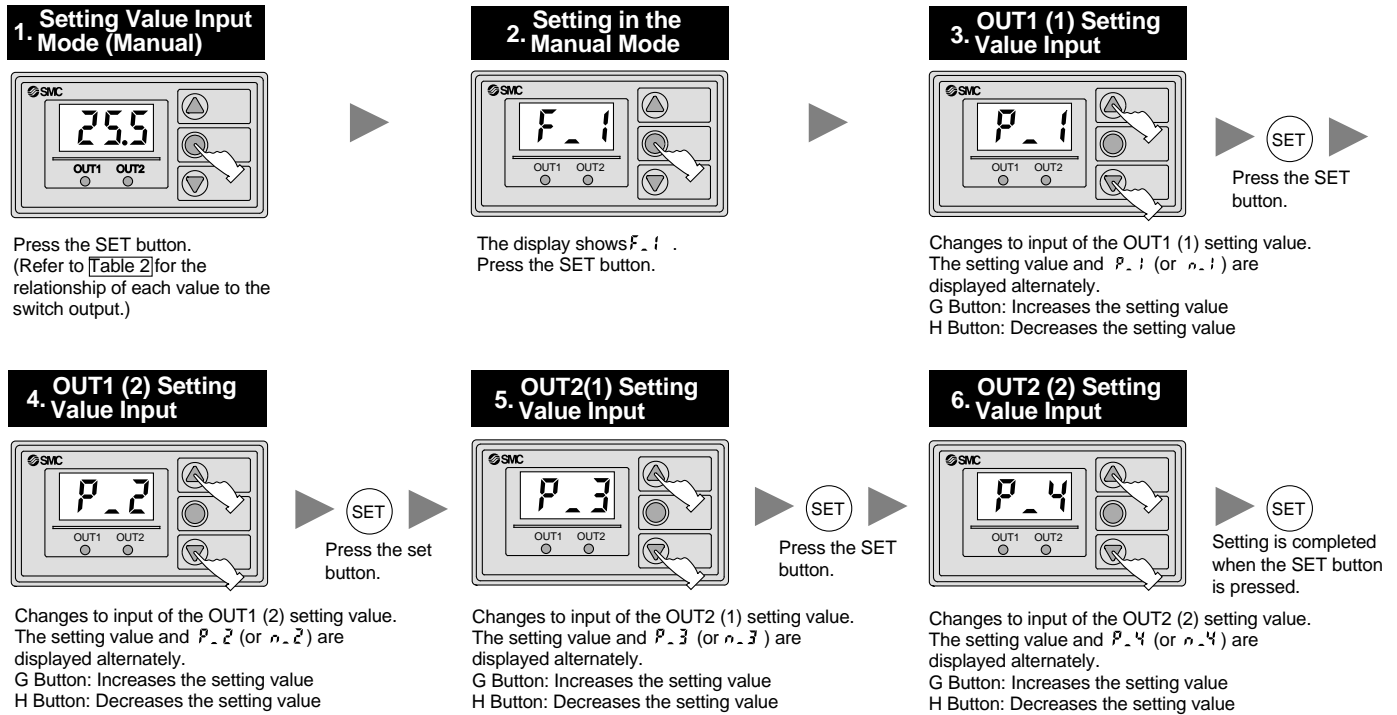
GPM = gal (US) /min

**Table 2** Output type

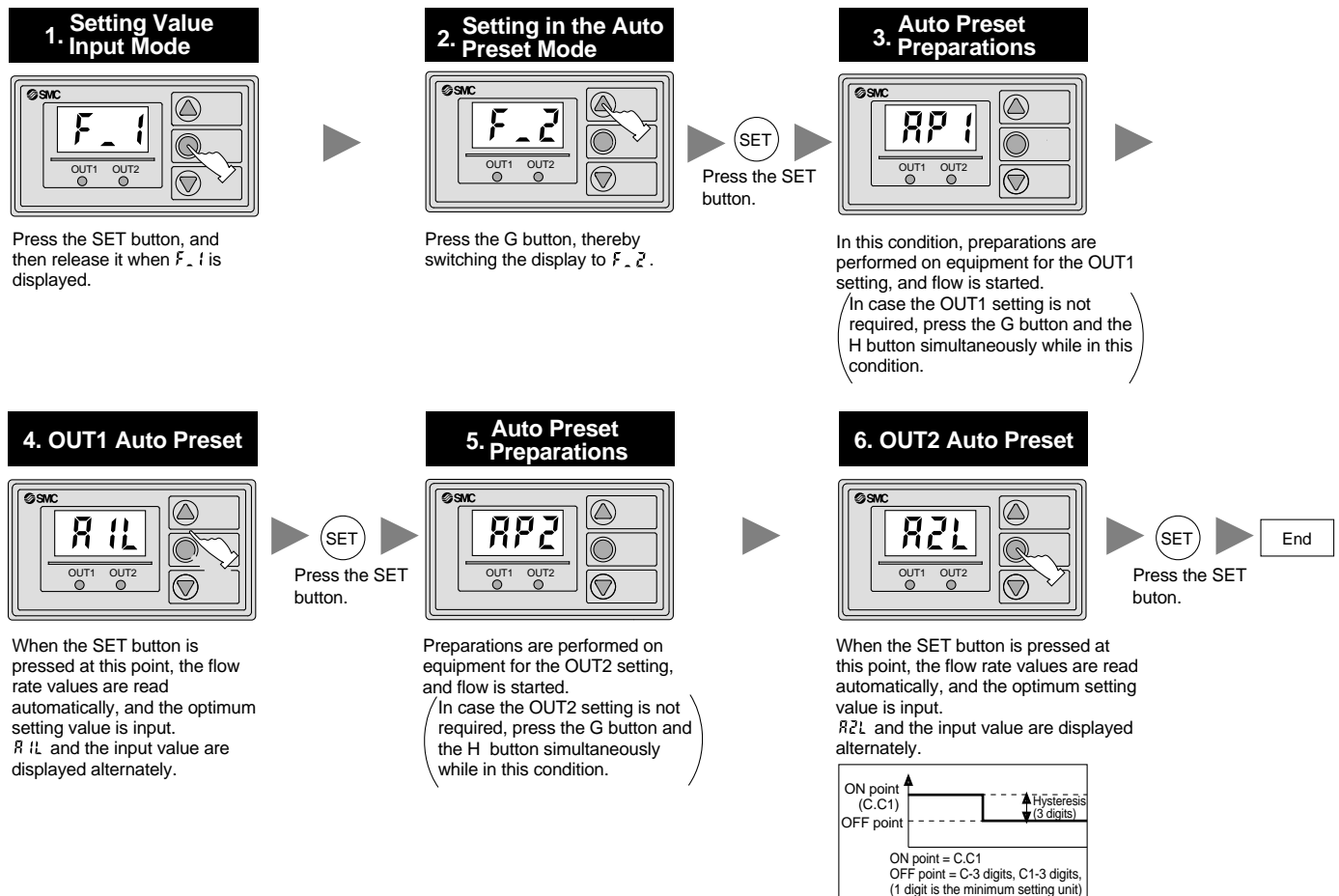


## Flow Rate Setting

### Flow rate setting mode (manual)



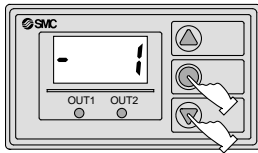
### Flow rate setting mode (auto preset)



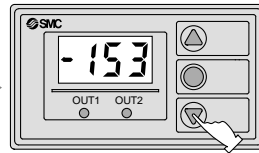
## Other functions

### • Cumulative flow rate function

#### Start of Accumulation

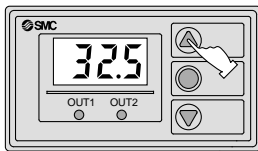


Accumulation start  
Press the SET button while pressing the H button. The - mark blinks and accumulation begins.

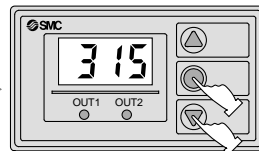


The value can be accumulated to 999999, but normally only the lower 3 digits are displayed. Press the H button to confirm the upper 3 digits.

#### Stopping Accumulation



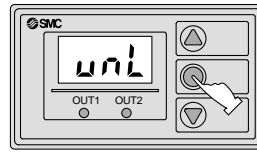
By pressing the G button, the instantaneous flow rate can be confirmed during accumulation.



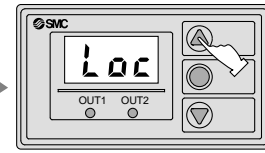
Press the SET button while pressing the H button. The display holds the value accumulated up to now and stops. To start further accumulation from this point, press the SET button while pressing the H button. The display can be cleared by pressing the G button and the H button simultaneously for 2 seconds or more.

### • Key lock mode ----- Prevents misoperation of buttons.

#### Start of key locking



Press the SET button continuously for 3 seconds or more. The display changes from F.t to uNL, and when it shows uNL, release the SET button.

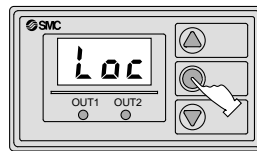


Using the G button, set the display to Loc.

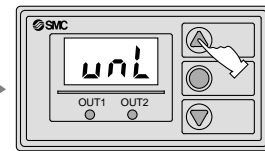
SET

Setting is completed when the SET button is pressed.

#### Release of Key Locking



Press the SET button continuously for 3 seconds or more. Release the SET button when the display shows Loc.



Using the G button, set the display to uNL.

SET

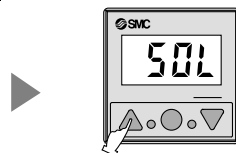
Setting is completed when the SET button is pressed.

### • Switching the flow rate range of the separate type (for air)

#### Flow Rate Range Switching



When the SET button is pressed continuously for 4 seconds or more, the display changes to 50L or 10L.



With the G button, match to the flow rate range being used.  
10L : for 1 to 10ℓ/min  
50L : for 5 to 50ℓ/min

SET

Setting is completed when the SET button is pressed.

## Error Correction

Take the following corrective actions when errors occur.

LED display	Problem	Corrective action
Er 1	A current of more than 80mA is flowing to OUT1.	Check the load and wiring for OUT1.
Er 2	A current of more than 80mA is flowing to OUT2.	Check the load and wiring for OUT2.
Er 4	The setting data has changed due to some influence.	Perform the RESET operation, and set all data again.
- - -	The flow rate is over the flow rate measurement range. (for air only)	Reduce the flow rate until it is within the flow rate measurement range, using an adjustment valve, etc.

## Connectors

Since the connectors (female contacts) shown below can be used, please refer to the respective manufacturers.

Connector size	Number of pins	Manufacturer	Applicable series
M12	4	C. CORRENS & CO., LTD.	VA-4D
		OMRON Corporation	XS2
		Yamatake-Honeywell Co., Ltd.	PA5-4I
		Hirose Electric Company	HR24
		DDK Ltd.	CM01-8DP4S

C. CORRENS & CO., LTD. is the general agent in Japan for Hirschmann.

## Internal Circuits and Wiring Examples

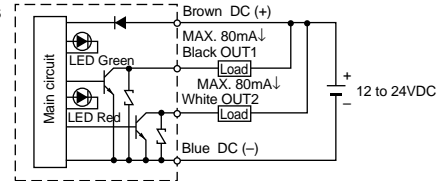
### Integrated type

-27

**NPN open collector**

30V, 80mA

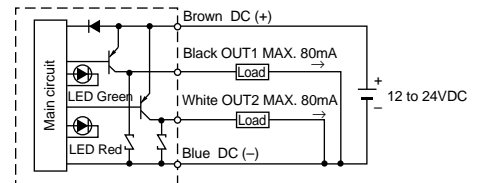
Residual voltage 1V or less



-67

**PNP open collector**

80mA

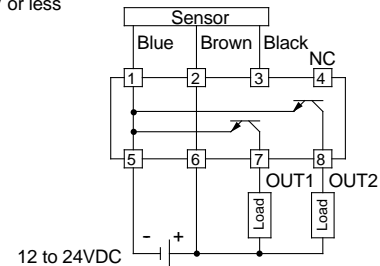


### Separate type

**NPN open collector**

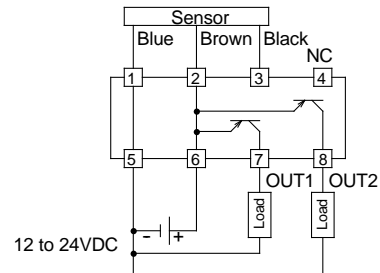
30V, 80mA

Residual voltage 1V or less




**PNP open collector**


80mA




\* Numbers inside □ are terminal numbers.

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe these precautions.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

## **Warning**

### **1. The compatibility of equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

### **2. Only trained personnel should operate pneumatically operated machinery and equipment.**

Equipment can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of systems should be performed by trained and experienced operators.

### **3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, first confirm that safety measures have been implemented.
3. Before machinery/equipment is re-started, confirm that safety measures have been implemented and proceed with caution.

### **4. Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

### Design and Selection

#### Warning

##### 1. Use with the specified voltage.

Use with voltage outside of the specifications can cause malfunction or switch damage, as well as electrocution and fire hazard, etc.

##### 2. Never use a load which exceeds the maximum load capacity.

This can cause damage to switches.

##### 3. Do not use loads which generate surge voltage.

The switch's output section is provided with a surge protection feature in its circuit, but repeated application can cause damage. When directly driving surge generating loads, such as relays and solenoid valves, etc., use a type of switch which has a built-in surge absorbing element.

##### 4. Since the fluids which can be used differ depending on the product, be certain to confirm the specifications.

Since switches do not have explosion proof construction, do not use flammable gases or fluids. This may cause fire or explosion.

##### 5. Take note of the switch's internal voltage drop.

When operated below the prescribed voltage, the load may not operate, even if the switch operates normally. Confirm the load's operating voltage and see that the following formula is satisfied.

$$\text{Power supply voltage} - \text{Switch's internal voltage drop} > \text{Load operating voltage}$$

#### [When used for air]

##### 6. Be certain to observe specifications for the measured flow rate and maximum operating pressure.

Operation at a flow rate exceeding the prescribed range can cause damage. In addition, the switch will be damaged if operated above the maximum operating pressure.

#### [When used for water]

##### 7. Be certain to observe specifications for the measured flow rate and maximum operating pressure.

Operation at a flow rate exceeding the prescribed range can cause damage. In addition, the switch will be damaged if operated above the maximum operating pressure. In particular, avoid application of pressure above the specifications caused by a water hammer.

#### <Example Pressure Reduction Measures>

- Use a water hammer relief valve, etc. to slow the valve's closing speed.
- Absorb impact pressure by using an accumulator, or elastic piping material such as rubber hose.
- Make the length of piping as short as possible.

##### 8. Design so that the flow of liquid always fills the detection passage.

Especially in the case of vertical mounting, set up so that flow moves from the bottom to the top.

### Design and Selection

#### Warning

##### 9. Operate at a flow rate within the flow rate measurement range.

If operated outside of the flow rate measurement range, the Karman vortex will not be generated and normal measurement will become impossible.

#### Caution

##### 1. The switch's data will not be cleared even if the power is turned off.

Since the input data is held in an EEPROM, it will not be cleared even if the power is turned off. Rewriting is possible up to 2,000 times, and the data holding time is 20 years.

### Mounting

#### Warning

##### 1. Mount switches using the proper tightening torque.

The switch may be damaged if it is tightened above the tightening torque range.

Also, if it is tightened below the tightening torque range, the connection thread section may become loose.

Nominal size of threads	Proper tightening torque N·m
1/8	7 to 9
1/4	12 to 14
3/8	22 to 24
1/2	28 to 30
3/4	28 to 30

1 N·m=10.2kgf/cm

##### 2. When connecting piping to the switch, do this by applying a wrench to the metal part which is integrated with the piping section.

Never apply a wrench to the portion which is made of resin, as this can cause damage to the switch.

##### 3. Pay attention to the fluid flow direction.

Install and connect piping so that fluid flows in the direction of the arrow indicated on the body.

##### 4. Before connecting piping to the switch, remove dirt, etc. from inside the piping by blowing it out with air.

##### 5. Do not drop or bump.

Do not drop, bump or apply excessive impacts (490m/s<sup>2</sup>) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

##### 6. Hold the product by the body when handling.

Since the tensile strength of the power cord is 49N (5kgf), pulling it with a force greater than this can cause damage. Hold by the body when handling.

##### 7. Use after confirming that equipment is operating properly.

After a new installation, system repair or renovation, connect the fluid and power, etc., and then perform appropriate function and leak inspections to confirm that mounting has been done correctly.



## Specific Product Precautions 2

Be sure to read before handling.  
Refer to page 23 for safety instructions.

### Mounting

#### Warning

[When used for air]

8. **Never mount a switch in a place that will be used as a scaffold during piping work.**

Damage may occur if subjected to an excessive load.

9. **Provide a section of straight pipe of at least 8 times the pipe diameter in the piping before and after a switch.**

Do not abruptly reduce the size of the pipe anywhere in the piping lines.

The pressure distribution in the piping will change, and accurate measurement will become impossible.

[When used for water]

10. **Never mount a switch in a place that will be used as a scaffold during piping work.**

Damage may occur if subjected to an excessive load. Especially when the switch supports piping, do not apply a load of 15N·m or more to the metal part of the switch.

11. **Provide a section of straight pipe of at least 8 times the pipe diameter in the piping before and after a switch.**

In cases where there is an abrupt reduction in the size of piping or restriction due to a valve, etc. on the upstream side, the flow velocity distribution in the piping is disturbed, and accurate measurement becomes impossible. Therefore, measures such as these should be implemented on the downstream side of the switch.

Furthermore, when used with the downstream side open, use caution as there is a danger that cavitation will easily occur.

### Wiring

#### Warning

1. **Confirm wire colors and terminal numbers when wiring is performed.**

Since incorrect wiring can lead to damage or failure of the switch as well as malfunction, perform wiring after confirming wiring colors and terminal numbers with the instruction manual.

2. **Avoid repeatedly bending or stretching lead wires.**

Broken lead wires will result from applying bending stress or stretching force to the lead wires.

3. **Confirm proper insulation of wiring.**

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. **Do not wire with power lines or high voltage lines.**

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits, including switches, may malfunction due to noise from these other lines.

5. **Do not allow short circuiting of loads.**

If a load is short circuited, an overcurrent error will be displayed by the switch, however, wiring should be performed carefully, as protection cannot be afforded against all miswiring (power supply polarity, etc.).

### Operating Environment

#### Warning

1. **Never use in an atmosphere of explosive gases.**

The structure of switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. **Mount switches in locations without vibration (98m/s<sup>2</sup> or less) or impact (490m/s<sup>2</sup> or less).**

3. **Do not use in an area where surges are generated.**

When there are units (solenoid type lifters, high frequency induction furnaces, motors, etc.) which generate a large amount of surge in the area around switches, this may cause deterioration or damage to the switch. Avoid sources of surge generation and disorganized lines.

4. **Avoid use in locations where water or oil, etc. is scattered.**

Switches are a dustproof and dripproof type, but avoid use in locations where a large amount of water or oil is scattered.

[When used for air]

5. **Observe the fluid and ambient temperature ranges.**

The fluid and ambient temperatures are 0 to 50°C. Since moisture in the fluid can freeze when used at 5°C or below, causing damage and malfunction of switches, consider measures to prevent freezing. The installation of an air dryer is recommended to remove drainage and moisture from circuits.

Furthermore, even though the ambient temperature range remains within specifications, do not operate in locations where there are abrupt temperature changes.

[When used for water]

6. **Observe the fluid and ambient temperature ranges.**

The fluid and ambient temperatures are 0 to 50°C. Since the fluid can freeze when used at 5°C or below, causing damage and malfunction of switches, consider measures to prevent freezing.

Furthermore, even though the ambient temperature range remains within specifications, do not operate in locations where there are abrupt temperature changes.

### Maintenance

#### Warning

1. **Perform inspections regularly to confirm normal operation.**

It may otherwise not be possible to assure safety due to unexpected malfunction or misoperation, etc.

2. **Use caution when using in an interlock circuit.**

When used in an interlock circuit, provide multiple interlock circuits as a precaution against failure, and also perform regular inspections to confirm normal operation.

3. **Do not disassemble or modify the unit.**

Be sure to read before handling.  
Refer to page 23 for safety instructions.

### Measured Fluids

#### Warning

1. **Check regulators and flow rate adjustment valves before allowing the flow of fluid.**

If a pressure or flow rate above the rating is applied to a switch, the sensor unit may be damaged.

**[When used for air]**

2. **Measured fluids for the switch are nitrogen and air.**

Note that accuracy cannot be guaranteed for other fluids.

3. **Never use flammable fluids.**

The flow velocity sensor is heated to approximately 150°C.

4. **In cases where there is a danger of drainage or foreign matter being mixed in the fluid, install a filter or mist separator on the upstream side.**

Otherwise, the rectifying device built into the switch will become clogged and accurate measurement will not be possible.

**[When used for water]**

5. **The measured fluid for the switch is water.**

Note that accuracy cannot be guaranteed for other fluids.

6. **Never use flammable fluids.**

7. **In cases where there is a possibility of foreign matter being mixed in the fluid, install a filter on the upstream side.**

If foreign matter adheres to the switch's vortex generator or vortex detector, accurate measurement will become impossible.

### Other

#### Warning

1. **Since switch output remains OFF for 1 second after power is turned ON, start measurement after this.**

2. **Perform settings after stopping control systems.**

Output turns OFF when the switch's initial setting and flow rate setting are performed.

3. **Do not apply excessive rotational force to the display unit.**

The display unit is able to rotate 360°. Rotation is controlled by a stopper, however, take note that the stopper may be damaged if the display is turned with excessive force.

**[When used for air]**

4. **Be certain to turn on the power when the flow rate is at zero.**

Allow an interval of 10 minutes after turning on the power, as there may be some changes in the display.

5. **Flow rate units**

The switch performs measurement at mass flow rates at which it will not be effected by temperature and pressure. The units used are  $\ell/\text{min}$ , where this display substitutes the volumetric flow rate at 0°C and 1 atmosphere (101kPa) for the mass flow rate.



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